

NOTES ON THE SMARIDIDAE (ACARINA) OF AUSTRALIA
AND NEW ZEALAND

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In this family Vitzthum (Kukenthal's Handbuch der Zoologie, 1931, 3, (2), 148) includes only the two genera *Smaris* Latreille 1796 (= *Smaridia* Latreille 1817 = *Fessonia* von Heyden 1826 = *Phanolophus* André 1927) and *Microsmaris* Hirst 1926, both of which have been recorded from Australia. From the allied Erythraeidae he separates the family (Tierwelt Mitteleuropas, 1929, 3, (7), 67) as follows:

"Mouth-parts not extrusile. Mandibles stylet-like. One or two sessile eyes. With crista metopica; two sensillary areas, on anterior and posterior ends of crista.

Erythraeidae Oudemans 1902

"Mouth-parts including palpi far extrusile. Mandibles stylet-like. One or two sessile eyes on each side. With or without crista metopica; one sensillary area on posterior end of crista or a corresponding position.

Smarididae Kramer 1878"

It is not clear why Vitzthum placed *Microsmaris* in the Smarididae, unless it was on the absence of a crista. The mouth-parts, however, are not extrusile in this genus, and it cannot therefore be placed in this family. Probably he had not seen any specimens and was misled by the name.

In Europe there are apparently only three species recognised with certainty, placed hitherto in the genus *Smaris* Latreille 1796.

Vitzthum (*loc. cit.*, 1929) separates these species thus:

"1 Without crista metopica. Anterior end of dorsum produced in a long extended process. Two eyes on each side. *S. squamata* (Hermann 1804)

"With crista metopica. Anterior end of dorsum without extended process. 2

"2 Body hairs in form of short leaves with serrated edge. Two eyes on each side. *S. papillosa* (Hermann 1804)

"Body hairs angular, the edges with wart-like serrations. Allegedly with only 1 eye on each side. *S. ampulligera* (Berlese 1887)"

Before considering the Australian species it will be necessary to evaluate taxonomically the characters used in the above key. At first glance, in this family as well as in the Erythraeidae, the presence or absence of crista, and possibly also of a nasus, may appear to be of generic value. But are there other characters to support this?

If we look at the figures of *S. squamata* given by Berlese (A.M.S. ital. Repta., fasc. v, No. 4), and again (*ibid.*, fasc. lxxi, No. 4) we observe two distinct dorsal shields, anterior and posterior, a large ventral shield embracing the anterior two pairs of coxae, a pair of lateral ventral shields embracing coxae III and IV, as well as a large quadrangular genital shield. On the posterior margin of the anterior dorsal shield, and well behind the paired eyes, is a single pair of sensory setae. In Berlese's figures, however, of *ampulligera* (*ibid.*, fasc. xxxix, No. 10; lxxi, No. 4) and *papillosa* (*ibid.*, fasc. xvi, No. 3; lxxi, No. 4) there is no suggestion of dorsal or ventral shields and no nasus; but there is a distinct linear crista with anterior and posterior sensillary areas, and in *papillosa* an additional sensillary area in the middle. The separation of *squamata* from the other two species on the absence of a crista and the presence of a nasus is supported by the presence of dorsal and ventral shields.

In 1916 Banks (Trans. Roy. Soc. S. Aust., 40, 225, pl. xxiii, fig. 5), described *Fessonia prominens* from ants' nests in Victoria. In 1934 (Rec. S. Aust. Mus., 5, (2), 225) the senior author recorded the same species from various localities in other States and suggested that it was not necessarily a myrmecophilous species. Unfortunately, in that paper, the species was erroneously placed in *Calyptostoma* (Calyptostomidae), a genus and family to which it has no relation. It is re-described and refigured as *Smaris promiuens* in this paper.

Although overlooked by Banks, the dorsal and ventral shields found in *squamata* are present in *promiuens*. They were apparently missed as the specimens were mounted in balsam; but remounting of his co-type, in the South Australian Museum collection, in gum-chloral, renders them visible. Banks, however, does refer to several dorsal patches free of hairs, and these correspond to the smaller muscular plates described later. His figure shows only a single sensillary arca with paired setae placed posterior to, but close to the eyes. It is obvious, however, that these do not correspond in position to those shown by Berlese for *squamata*. Banks also shows a distinct nasus but no crista.

Re-examination of the Australian *S. promiuens* shows that there are actually two pairs of sensory setae, an anterior pair as figured by Banks, and a posterior pair (as shown by Berlese for *squamata*) on the posterior margin of the anterior shield. It appears, then, that whereas Banks overlooked the posterior pair of sensillae in *promiuens*, an anterior pair, missed by Berlese, probably occurs in the European *squamata*.

Berlese (Bull. Soc. ent. Ital., 1888-90) records *Smaridia ampulligera* var. *longipes* and *S. depilata* n. sp. from South America. In the latter species he describes and figures a large diamond-shaped anterior dorsal shield and seven smaller posterior plates, one in the midline, the others more lateral; that in the midline probably corresponds to the posterior shield in *squamata*, but the others are probably muscular plates. On the anterior dorsal shield he shows two pairs of sensillae as in *promiuens* and both posterior to the single eyes. The species is obviously closely related to *promiuens* and *squamata*.

With regard to the eyes, Berlese (A.M.S., 1883, fasc. v, No. 4) clearly figures *S. squamata* (*Rhyncholophus squamatus*) as having only one eye on each side. In 1887 (*loc. cit.*, fasc. xxxix, No. 10) he stated that whereas previously (*loc. cit.*, 1884, fasc. xvi, No. 3) he figured *papillosa* with only one eye on each side, there was a smaller additional eye present on each side, which he had not been able to see in *squamata* and *ampulligera*. Later (*loc. cit.*, 1894, lxxi, No. 4) he describes and figures 2 + 2 eyes in *squamata*. Accordingly it appears reasonable to suppose that he missed the 2 + 2 eyes in the South American *depilata*.

It is evident, then, that *squamata*, *promiuens* and *depilata* are closely related in the absence of a crista, the posterior position of both pairs of sensillae with regard to the eyes, and the presence of dorsal shields; but are yet generically distinct from *ampulligera* and *papillosa*, hitherto placed under *Smaris* (s.l.).

As *squamata* Hermann is the type of *Smaris* it is proposed to restrict this generic name to the above three species. Of the other two species, *papillosa* Hermann is, according to Oudemans (Krit. Overz. d. Ac., III C. 954), the type of *Fessonia* von Heyden 1826. It differs from *ampulligera* in having a third and middle sensillary area to the crista and two eyes on each side.

It remains for European workers to re-investigate the presence or otherwise of the anterior pair of sensillae in *squamata* and whether *depilata* has 2 + 2 or 1 + 1 eyes.

Recently (Psyche, 45, (2-3), 1938, 123) Jacot has rediscovered and re-described Say's American species *Trombidium sericeum*, and shown that it should be placed in *Smaris* (s.l.). It has both a linear crista and a short nasus but there is no suggestion of dorsal or ventral shields. In addition, Jacot also briefly describes but does not name a second very similar species of *Smaris* from North America. Both these species are obviously closely related to *ampulligera*.

A re-examination of the Australian *Hirstiosoma scalaris* Womersley, and of the New Zealand *H. novae-hollandiae* Womersley shows that both have extrusile mouth-parts and are closely related to *ampulligera* and to Jacot's two species. All these are generically distinct from *papillosa* (*Fessonia*) and *squamata* (*Smaris*) and accordingly require a new generic name for which *Hirstiosoma* Womersley is available, with *scalaris* Womersley as the type. In addition to the genotype it will include *H. sericea* (Say, Jacot) *H. sp.* Jacot, from North America, *H. novae-hollandiae*, New Zealand, and **H. tasmaniensis** n. sp., Tasmania.

Another genus which must be included in the Smarididae, as understood here, is *Sphaerotarsus* (genotype *S. allmani* Womersley 1936) from Australia. It is closely related to *Hirstiosoma* even in the general form of the dorsal setae, differing in having the posterior sensillary setae clavate and the ♂ hind tarsus enlarged. The genus includes *S. ripicolus* (Womersley 1934), *S. allmani* Wom. 1936, **S. leptopilus** n. sp., and **S. claviger** n. sp., all four being from Australia.

The four genera included in the family can be keyed as follows:

- 1 Crista absent, two sensillary areas with paired sensory setae, both placed posterior to the paired eyes. Dorsal and ventral shields present, anterior dorsal plate produced to a nasus. 2
Smaris Latreille 1796.
type *S. squamata* (Hermann 1804)
- Crista present, linear, with 2 or 3 sensillary areas, each with paired sensillae. Dorsal plates or shields absent. Eyes 2 + 2 or 1 + 1 about level with middle of crista.
- 2 Crista with 3 sensillary areas. Eyes 2 + 2. *Fessonia* von Heyden 1826 3
type *S. papillosa* (Hermann 1804)
- Crista with only 2 sensillary areas, anterior and posterior. Eyes, 1 + 1.
- 3 Posterior sensillary setae tapering with ciliations minute or absent. Hind tarsi in ♂ normal.
Hirstiosoma Womersley 1934
type *H. scalaris* Womersley 1934
- Posterior sensillary setae clavate, strongly ciliated. Hind tarsi in ♂ greatly enlarged.
Sphaerotarsus Womersley 1936
type *S. allmani* Womersley 1936

Genus SMARIS Latreille

Précis car. gén. Ins., p. 180, 1796.

SMARIS PROMINENS (Banks 1916) Text fig. 1, A-T; 2, A-I; 3, A-C

Fessonia prominens Banks, Trans. Roy. Soc. S. Aust., 1916, 40, 225.

Calyptostoma prominens Womersley, Rec. S. Aust. Mus., 1934, 5, (2), 235

Redescription of Adult, fig. 1, A-P—Colour brown to reddish. Oval in outline with rather prominent shoulders. With distinct nasal process. Dorsum rather flat with raised marginal areas giving a sunken central portion which extends anteriorly on each side to the origin of the nasus. Length to 1.0 mm., width to 0.5 mm., greatest anterior to the middle.

Dorsally with two distinct shields; the anterior pear-shaped with the apex forming the nasus, anteriorly with two sessile eyes on each side on indistinct ocular plates, behind the eyes in the midline is a pair of sensillae, 43 μ long with their pits 49 μ apart; on the posterior margin of this shield is a second pair of sensillae, 47 μ long, with their bases 18 μ apart and the pits conjoined to form a sensillary area, the distance between anterior and posterior sensillae is 220 μ and both pairs are finely ciliated; this anterior shield extends to the middle of the body length and laterally to half-way between the midline and the lateral body margins, its length is 450 μ , width 280 μ ; the posterior dorsal shield is roundish in the ♀, 180 μ long by 140 μ wide, in the ♂ it is rather straight on the anterior margin and somewhat larger than in the ♀, 250 μ by 220 μ . In both sexes between the anterior and posterior shields are two pairs of small subcuticular muscular plates which are roundish and somewhat angled medially, in the ♂ the posterior

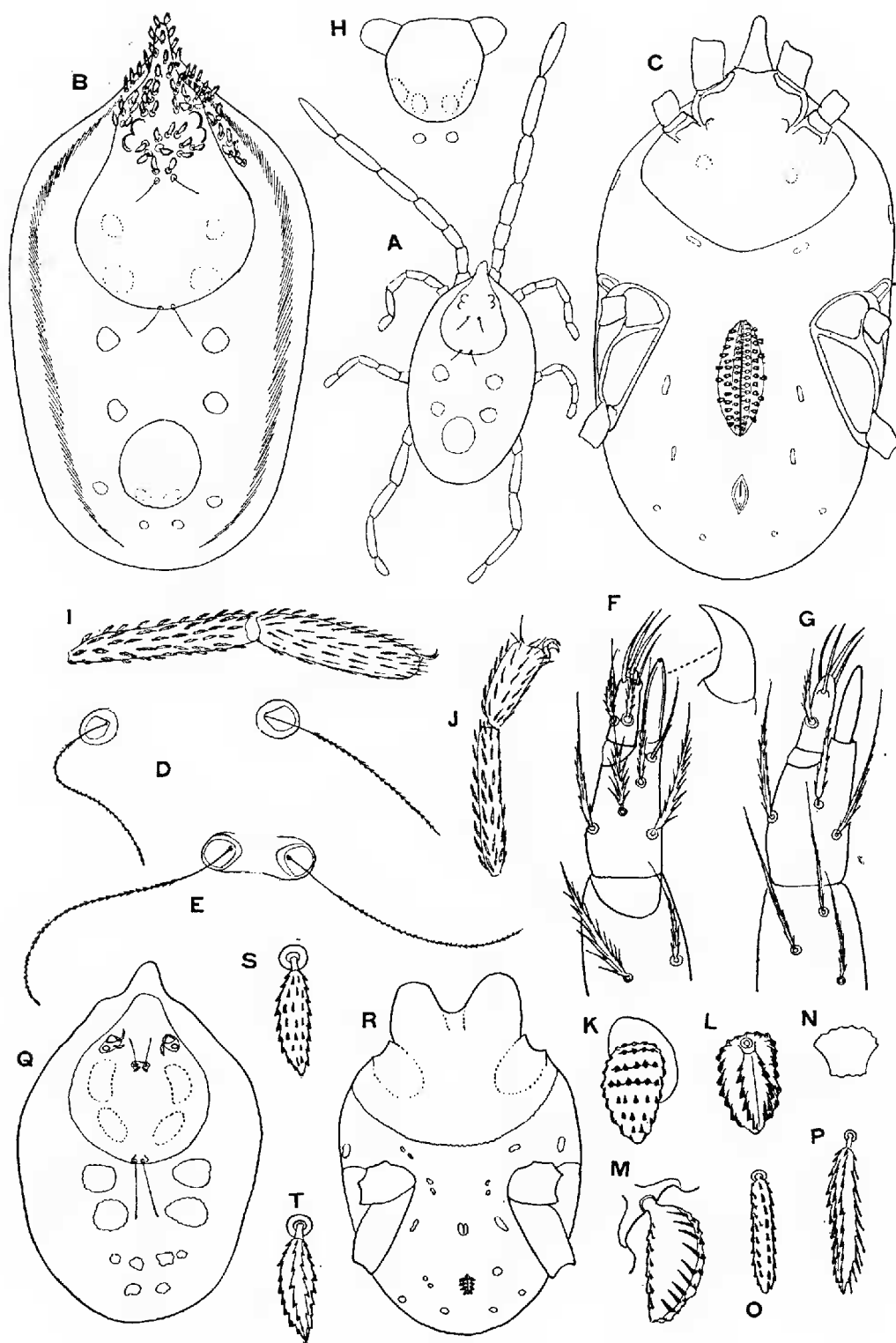


Fig. 1

Smaris prominens (Banks 1916)—A–P adult: A, entire dorsal view ♀; B, dorsum ♀; C, venter ♀; D, anterior sensillae; E, posterior sensillae; F, palp dorsal; G, palp ventral; H, post. dorsal plate ♂; I, tarsus and metatarsus I; J, tarsus and metatarsus IV; K, L, M, N, different aspects of dorsal setae (N, transverse section); O, P, leg setae; Q–T, nymph; Q, dorsum; R, venter; S, T, dorsal setae from above and below.

pair are attached to the anterior angles of the posterior shield, giving it a widened appearance anteriorly, other smaller muscular plates are as figured. Ventrally the anterior coxae are on a large somewhat triangular shield 385 μ long and 385 μ wide; the posterior coxae are on triangular lateral shields, 305 μ long by 180 μ wide; smaller muscular plates are present as figured. The genital opening is externally the same in both sexes, 280 μ long by 45 μ wide, the lips are furnished with about 18 simple spine-like setae, and outside these lips the cuticle is raised as a pair of outer ridges furnished with normal ventral setae; in neither sex are genital discs present. Legs: I 1,100 μ long, II 660 μ , III 630 μ , IV 1,020 μ (including coxae); tarsus I elongate, 190 μ by 40 μ high; metatarsus I 225 μ ; all tarsi without scopulae, no difference between metatarsi and tarsi IV of δ and ♀ . Setae: dorsal short and oval, rather flattened ventrally, broadly convex dorsally, with longitudinal rows of adnate serrations, 15-20 μ long; laterally on anterior end of dorsum are a few similar but longer ones to 45 μ ; ventral setae similar to dorsal but mostly shorter 12-14 μ , some 28 μ ; most leg setae similar to dorsal, 20 μ ; various types of sensory setae are also present on the legs.

Mouth-parts extrusile, palpi with fine indistinctly ciliated setae dorsally, strongly ciliated ventrally, tarsus of palp shorter than the strongly curved claw and with one blunt sensory seta, three strong simple setae and four ciliated setae.

Remarks—From the figures of *squamata* given by Berlese and already referred to, our Australian species differs in the size and shape of the dorsal and ventral shields. In *squamata* the anterior shield extends much further back and is square-ended; in *prominens* it is shorter, more pear-shaped and rounded posteriorly. The posterior shield is larger and longer in *squamata*, and there is a wide quadrangular genital shield not present in *prominens*.

Description of larvae, fig. 2, A-I—Colour orange. Shape roughly ovoid, widest anterior to the middle, evenly rounded posteriorly, somewhat tapering anteriorly, length ranging from 223 μ , to 460 μ when fully gorged, width 184 μ of a specimen 254 μ long. With a single dorsal shield, as figured, with concave anterior and convex posterior margin, length 28 μ , width 45 μ , depth of anterior concavity 4 μ ; with two pairs of ciliated sensillae placed as shown; anterior 27 μ posterior 44 μ ; with two pairs of ordinary fairly stout ciliated setae placed at the anterior and posterior angles, anterior 45 μ long, posterior 32 μ . Eyes 2 + 2, postero-lateral to dorsal shield, anterior ocellus the larger. Dorsum with about 44 brown fairly stout blunt ciliated setae, 24-41 μ long, arranged 4.4.4.4(5). 4.4.4.8(9).4.2.

Venter: each coxa with one ciliated seta, on I 32 μ long, II 20 μ , III 26 μ , that on III blunt at tip, others pointed. Between coxae I a pair of bushy ciliated setae, 16 μ long; a pair of pointed ciliated setae, 20 μ long, between coxae III, none between coxae II, but in the usual position of such setal bases is a pair of small rings suggestive of pores rather than the bases of setae; behind coxae III are three rows of blunt ciliated setae, 20-24 μ long, arranged 4.4.3. Legs stout, I 285 μ long, II 285 μ , III 337 μ (including coxae); tarsus I 57 μ long, 30 μ high. Claws strongly pulvilliform, empodium claw-like slender and curved, much longer than the claws; tarsi I with setae as figured, metatarsus I 47 μ long.

Mouth-parts and palpi as figured; palpal claw trifurcate; femur, genu, tibia and tarsus with 1, 1, 3, 6 setae respectively.

Remarks—No larvae appear to have previously been referred to the Smarididae. Within the Erythraeidae the genus *Bochartia* Oudemans, Zool. Jahrb., Suppl. 14, pt. i, 1912, p. 126 (type *B. kuyperi* Ouds.) appears to be most closely related to the larvae of *Smaris prominens*. They agree in having a dorsal shield wider than long, furnished with two pairs of ordinary ciliated setae, and two pairs of sensillary setae, and in having 2 + 2 eyes and coxae well separated. *S. prominens* differs from all Erythraeid larvae in that the two tarsal claws are

identical, strongly pulvilliform with long cilia; the palpal claw is tri- and not bifurcate as in *Bochartia*. It also differs from this genus in the scutum being crescentic or oblong rather than circular, with distinct anterior and posterior lateral angles.

Description of Pupa, fig. 3, A-C—Colour orange. Shape ovoid with a flattened ventral surface. Length $455\ \mu$, width $295\ \mu$; dorsal surface strongly

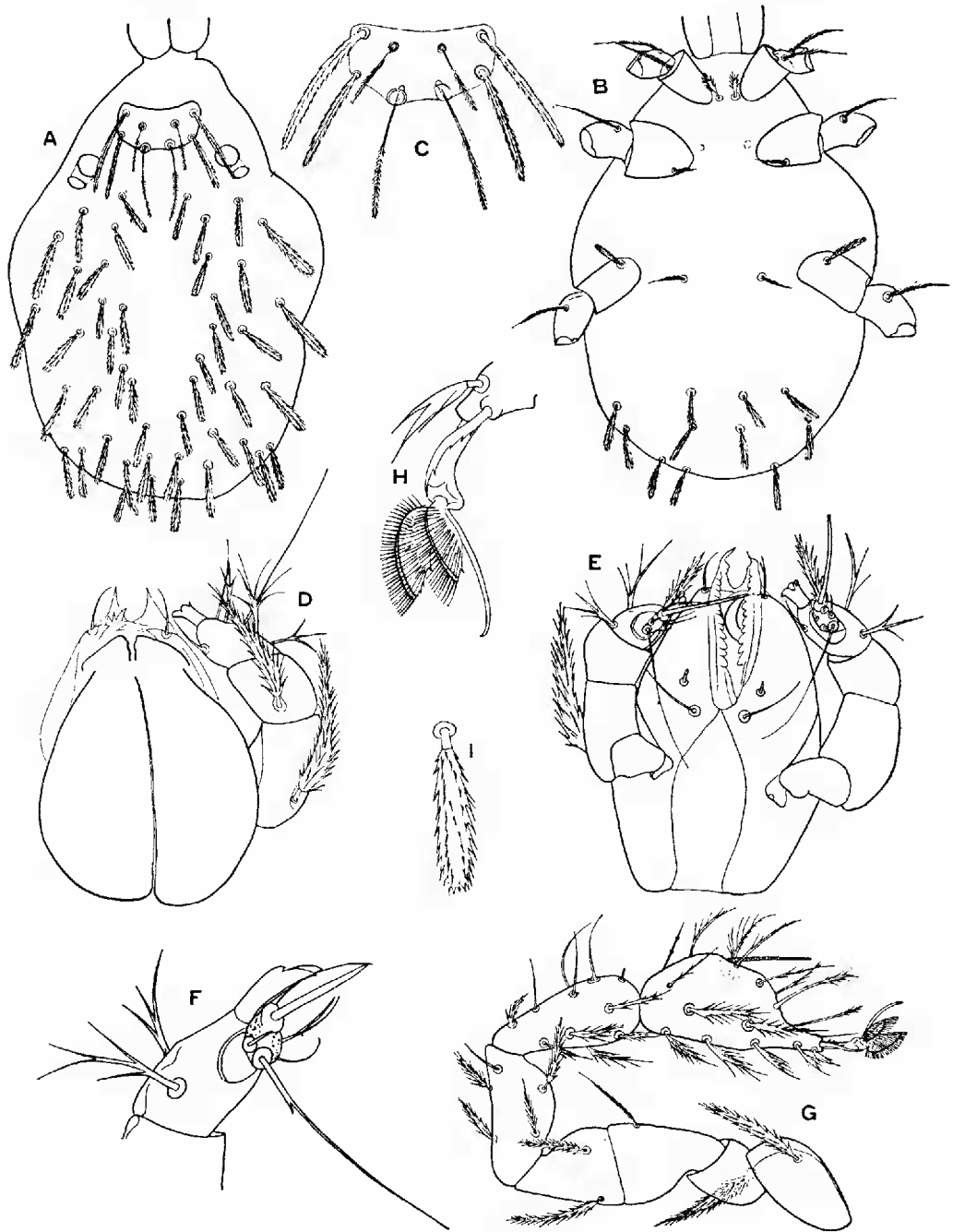


Fig. 2

Smaris prominens (Banks 1916)—Larva: A, dorsal; B, ventral; C, dorsal scutum; D, capitulum and right palp, dorsal; E, capitulum and palpi from below; F, tip of palp; G, leg I, posterior aspect; H, tip of front tarsus and claws; I, dorsal seta.

convex with the anterior end notched. Laterally the ventral surface is raised, the lateral areas merging at each end into two pairs of raised bosses in which the nymphal tarsi develop. The sunken central area is broadly convex. The dorsum entirely, and the venter peripherally, with long parallel-sided, apically-pointed setae, with serrations, setae 68-80 μ long, a few elongate-lanceolate and 34 μ long, each seta arising from a definite papilla. In well-developed pupae the nymphal parts can be seen, the eye spots being visible throughout the whole pupal stage. At first the eye spots are wide apart as in the larva, then approach gradually until the nymphal position is assumed. In ecdysis the larval skin splits transversely, one half remaining attached to each end of the pupa. The anterior half of the cast skin has the mouth-parts, legs I and II and the dorsal scutum; legs II separate to some extent from this part. The posterior half consists of the remainder, excepting perhaps the eyes, whose fate has not been ascertained.

Description of freshly emerged Nymph, fig. 1, Q-T—Colour orange. Shape oval, rather flattened dorsally with raised lateral border as in adult, length 490 μ , width 315 μ . Dorsum with only the anterior pear-shaped shield present; this

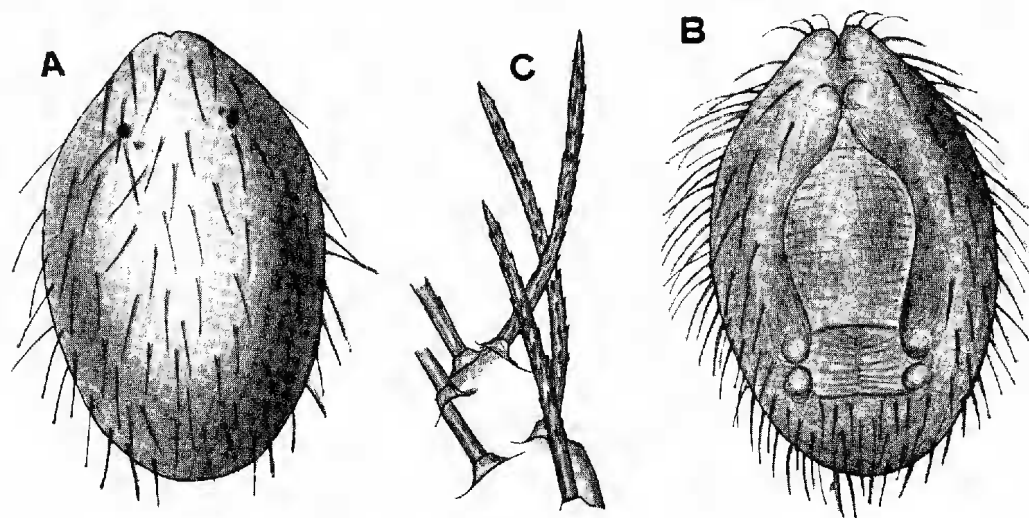


Fig. 3

Smaris prominens (Banks 1916)—Pupa: A, dorsal; B, ventral; C, setae.

carries 2 + 2 eyes and two pairs of sensillae as in the adult. The anterior sensillae are 34 μ long, their bases 39 μ apart, the posterior 57 μ and 14 μ respectively; they are all fine and shortly ciliated; as in the adult there is no crista and both pairs of sensillae are posterior to the paired eyes, the distance between the pairs of sensillae is 129 μ . With four large and a number of smaller muscular plates as in the adult.

Dorsal setae of similar form, but more elongate than in adult, 18-20 μ long, some laterally near the nasus 40 μ . Ventral setae similar to dorsal, 16-24 μ long. Coxae on ventral shields as in adult. Small ventral muscular plates as figured, devoid of cuticular striations. No genital organs present. Mouth-parts extrusile. Palpal claw stout, simple, curved.

Legs slender, I 662 μ long, II 303 μ , III 430 μ , IV 573 μ (all including coxae); tarsus I 123 μ long by 45 μ high, metatarsus I 135 μ long; normal setal clothing of legs as in adult, various sensillae also present; tarsal claws two, falciform, finely ciliated.

Localities—New South Wales: Bathurst, under logs, October 1932, one specimen (S. L. A.); Menindee, July 1928, three adults (S. H.). Victoria: Ocean Grove with *Iridomyrmex nitidus*, date? (A. M. L.), (\varnothing co-type of *Fessonia prominens* Bks. in S. Aust. Museum). South Australia: Urrbrae,

under bark, September 1933, one nymph (H. W.); Encounter Bay, with termites, January 1934, one adult (H. W.); Mount Barker, in moss, July 1934, one nymph (H. W.); Bordertown, December 1934, one adult (R. V. S.); Myponga, in moss, April 1935, one nymph (R. V. S.); Belair, May 1935, one adult (H. W.), January 1940, one adult (J. S. W.), May 1940, two adults (R. V. S.); Sellick's Beach, February 1937, one adult (H. M. H. and K. S.); Unley Park, August 1938, two adults and one nymph, October 1940, one nymph, all under eucalypt bark (R. V. S.); Torrens Gorge, in burnt stump of *Xanthorrhoea*, April 1939, one adult and three nymphs (R. V. S.); Glen Osmond, adults found throughout the year, 1935-40, particularly from April to June, nymphs from April to October and particularly April to May; both from soil, vegetable debris and under eucalypt bark; larvae found in similar habitat either free or attached to the introduced and cosmopolitan Psocid *Liposceles (Troctes) divinatorius* (Linn.), March 1935 (one specimen), April 1939 (8), May 1939 (2), April 1940 (2), (all R. V. S.).

NOTES ON THE BIOLOGY OF SMARIS PROMINENS (Bks.)

In trying to trace the life-history of this mite attempts to obtain eggs from adults in captivity have so far been unsuccessful. It has been possible, however, to rear nymphs from larvae attached to Psocids and these nymphs have been correlated with the adults on morphological grounds. The details of the four successful rearings (by the junior author) are given in the following table:

Specimen	ACA 324		ACA 326		ACA 654		ACA 661	
	Date	Period in Days	Date	Period in Days	Date	Period in Days	Date	Period in Days
Mite found	9 Apr. 39	—	7 May 39	—	21 Apr. 40	—	28 Apr. 40	—
Left host	12-15 Apr. 39	—	12 May 39	—	24 Apr. 40	—	—	—
Became dormant ...	12-15 Apr. 39	0	13-15 May 39	0	24 Apr. 40	0	after 29 Apr. 40	0
Skin split	18-19 Apr. 39	3-7	22 May 39	7-9	28-9 Apr. 40	4-5	before 20 May 40	0-30
Nymph emerged ...	12 May 39	27-30	after 5 June 39 ⁽¹⁾	21-24	29 May 40	35	after 19 June 40 ⁽²⁾	31-51 +
Nymph still alive ..	Killed at once		—	—	16 Aug. 40	—	—	—

⁽¹⁾ Tube not examined until December 1939, when a dead nymph and cast larval and pupal skins were found.

⁽²⁾ Pupa put into formalin; the nymph was apparently ready to emerge, showing strong development as compared with ACA 654.

The mites, together with their hosts, were kept in separate damp tubes supplied with pieces of bark or paper. When fully gorged the mites left their hosts and wandered freely about the tube for several days before becoming dormant. After several more days the skin splits transversely, revealing the pupa. Three to four weeks later the nymph emerges from a rent towards the posterior end of the pupa. After each experiment the larval skins were checked to ensure correct correlation of larva and nymph. Whether a second resting stage and nymph occurs has not been ascertained, but seems to be unlikely. One of the reared nymphs (ACA 654) lived in captivity for 80 days without any sign of further ecdysis and without any increase in body length or distance between the pairs of sensillae. Larger nymphs than the one described have been taken in the field, one from Glen Osmond, May 1937 measured $770\ \mu$ long, $460\ \mu$ wide, and $157\ \mu$ between pairs of sensillae. These dimensions, *i.e.*, body nearly as big as adult, but with distance between sensillae corresponding to proven first stage nymphs, indicate that probably there is only one nymph.

Genus HIRSTIOSOMA Womersley

Rec. S. Aust. Mus., 1934, 5, (2), 242. Type *H. scalaris* Wom., 1934 (*loc. cit.*).

HIRSTIOSOMA SCALARIS Womersley Fig. 4, A-F; 5, A-E

Rcc. S. Aust. Mus., 1934, 5, (2), 242.

Redescription of Adult, fig. 4, A-F; 5, A-C, E—Colour red. Oval in outline with prominent shoulders and a short nasus. Length 1.0 mm., width 0.65 mm. Crista linear with two sensillary areas, anterior and posterior each with two sensillae; anterior sensillae 30 μ long, expanding slightly distally, distal half with longer outstanding ciliations, proximal half with very minute adpressed ciliations, posterior sensillae very slender and tapering, 85 μ , with adpressed minute ciliations barely visible under high magnification. Distance between anterior and posterior sensillae 300 μ . Eyes 1 + 1, level with middle of crista. Palp as figured. Dorsal setae numerous, brown but not heavily pigmented, 3-flanged, 16-24 μ long. Ventral setae posteriorly similar to dorsal, anterior to genitalia oval with long strong ciliations, 14-16 μ long. Legs: I 1,230 μ long, II 650 μ , III 640 μ , IV 960 μ (including coxae), tarsus I 180 μ by 45 μ high, metatarsus 240 μ , tarsus IV 81 μ by 34 μ high, metatarsus IV 228 μ long.

Description of Nymph, fig. 5, D-E—Colour red. Shape as in adult. Length 500 μ , width 295 μ . Crista and sensillary setae as in adult. Anterior sensillae 26 μ long, posterior 85 μ , distance between anterior and posterior 188 μ . Eyes 1 + 1 level with middle crista. Dorsal setae similar to adult but more elongate, 18-28 μ long; ventral setae posteriorly similar to dorsal, more anteriorly elongate-oval, 14-16 μ long, with long strong ciliations. Legs not available.

Localities—South Australia: Victor Harbour, by sweeping tea-tree on banks of Hindmarsh River, one adult (type), January 1934 (H. W.); Glen Osmond, in soil at base of eucalypts, January 1938, two adults, February 1939, one adult, December 1939, one nymph, January 1940 one adult, December 1940, one adult, January 1941, one adult (R. V. S.); Rocky River, Kangaroo Island, one adult, under stone, December 1939, (R. V. S.).

Hirstiosoma tasmaniensis n. sp. Fig. 4, G-O; 5, F-J

Description of Adult, fig. 4, G-N; 5, F-H, J—Colour brownish. Oval in outline with prominent shoulders, length 1.4 mm., width 0.83 mm. Propodosoma produced into a nasus about 160 μ long. Crista linear with anterior and posterior sensillary areas each with paired sensillae, anterior sensillae strong, tapering, pointed, 50 μ long, with minute ciliations, posterior sensillae strong, long, tapering, pointed, 97 μ long, with minute ciliations, distance between anterior and posterior sensillae 323 μ . Eyes 1 + 1, level with middle of crista. Palp as figured, setae spiniform, with fine ciliations. Dorsal setae numerous, dark brown (heavily pigmented), 3-flanged, 24-31 μ long; ventral setae posteriorly similar to dorsal, anterior to genitalia oval with long strong ciliations, 14-22 μ . Legs: I 1,640 μ , II 900 μ , III 960 μ , IV 1,375 μ (including coxae); tarsus I 224 μ long by 75 μ high; metatarsus I 255 μ long; tarsus IV 97 μ long by 68 μ high, metatarsus IV 265 μ long.

Description of Nymph, fig. 4, O; 5, I—Colour brownish. Shape as in adult, length 510 μ , width 255 μ . Crista linear, as in adult, anterior sensillae fairly strong, only slightly tapering, pointed, 38 μ long, with fine ciliations, posterior sensillae more slender, tapering, pointed, 87 μ long, with minute ciliations, distance between anterior and posterior sensillae 183 μ . Eyes 1 + 1, level with middle of crista. Dorsal setae similar to adult but more elongate, 22-34 μ long; ventral setae posteriorly similar to dorsal, more anteriorly a long oval with long strong ciliations, and 14-16 μ long. Legs I: 1,020 μ long, II 460 μ , III 465 μ , IV 745 μ (including coxae); tarsus I 150 μ long by 54 μ high, metatarsus I 160 μ long, tarsus IV 60 μ by 36 μ , metatarsus IV 195 μ long.

Localities—Tasmania: Mount Wellington, December 1937, one adult and one nymph; Hobart, in moss, March 1940, five adults (one the type), (J. W. E.).

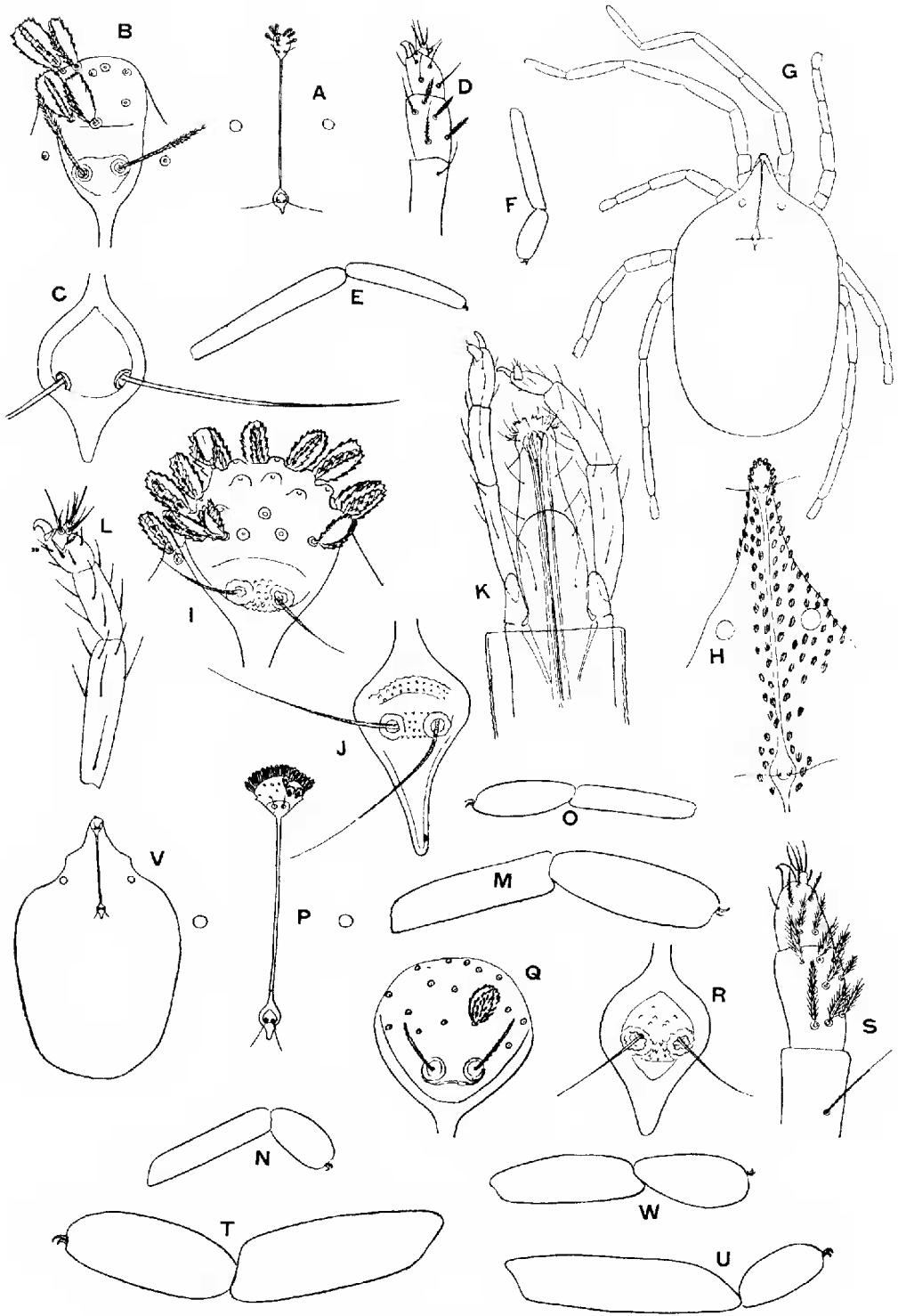


Fig. 4

HIRSTIOSOMA NOVAE-HOLLANDIAE Womersley Fig. 4, P-W; 5, H-M

J. Linn Soc., London, (Zool.), 1936, 40, 118

Redescription of Adult, fig. 4, P-U; 5, K-M—Colour brownish. Oval in outline with prominent shoulders and a short nasus. Length 1.5 mm., width 0.95 mm. Crista linear, with anterior and posterior sensillary areas each with two sensillae; anterior sensillae fairly stout, almost parallel-sided, finely ciliated, $26\ \mu$ long; posterior sensillae $45\ \mu$ long, tapering, pointed, ciliations doubtfully visible at 3,000 diameter, distance between anterior and posterior sensillae $414\ \mu$. Eyes 1 + 1, very slightly behind middle of crista. Palp as figured. Dorsal setae numerous, brown (heavily pigmented), 3-flanged, dorsal flange very broad and frequently with excavations, setae $24\text{--}26\ \mu$ long; ventral setae posteriorly similar to dorsal, anterior to genitalia oval with long strong ciliations, $16\text{--}20\ \mu$ long. Legs: I $1,620\ \mu$ long, II $1,030\ \mu$, III $1,110\ \mu$, IV $1,420\ \mu$ (including coxae); tarsus I $230\ \mu$ long by $125\ \mu$ high, metatarsus I $345\ \mu$ long; tarsus IV $115\ \mu$ long by $62\ \mu$ high, metatarsus IV $305\ \mu$ long.

Description of Nymph, fig. 4, V-W; 5, M—Colour brownish. Shape as in adult. Length $835\ \mu$, width $525\ \mu$. Crista linear with sensillary areas as in adult, anterior sensillae $18\ \mu$ long, fairly stout, slightly tapering and finely ciliated; posterior sensillae as in adult, $40\ \mu$ long, distance between sensillae $254\ \mu$. Eyes 1 + 1, behind middle of crista. Dorsal setae similar to adult but more elongate and less heavily pigmented, $22\text{--}28\ \mu$ long; ventral setae posteriorly similar to dorsal, more anteriorly similar, but with strong ciliations, $16\text{--}22\ \mu$ long. Legs: I $1,125\ \mu$ long, II $640\ \mu$, III $645\ \mu$, IV $845\ \mu$ (including coxae); tarsus I $145\ \mu$ long by $60\ \mu$ high, metatarsus I $215\ \mu$ long; tarsus IV $73\ \mu$ long by $32\ \mu$ high, metatarsus IV $200\ \mu$ long.

Locality—New Zealand: Manurewa, Auckland, May 1934, one adult (type), (E. D. P.); August 1934, one δ and one nymph (E. D. P.).

GENERAL REMARKS ON THE GENUS HIRSTIOSOMA

The specific differences in this genus, although small, are important. The principal ones are the dimensions of the metatarsus and tarsus of leg I, the characters of the sensillary setae of the crista and the structure of the dorsal setae.

Previously the senior author (J. Linn. Soc., London, (Zool.), 1936, 40, 118) used the character of the setae arising from papillae at the tip of the tarsi as being of value in separating *scalaris* and *novae-hollandiae*, those of *scalaris* having earlier (Rec. S. Aust. Mus., 5, (2), 242, 1934) been considered as simple. Actually these setae are ciliated in all species (both adult and nymphal) of the family of which we have specimens. A key to the three species from Australia, Tasmania and New Zealand is given but their exact relationship to the other species cannot be determined from the published data.

In A.M.S. ital. Repta., xxxix, No. 10, Berlese shows the anterior sensillae of *ampulligera* as relatively short thick and apically pointed with distinct ciliations, posterior sensillae as long and slender without ciliations. In the same work, lxxi, No. 4, for the same species he shows them both as long and slender, without

Fig. 4

Hirstiosoma—A-F, *scalaris* Wom. 1934, adult: A, crista and eyes; B, anterior sensillary area; C, post. sensillary area; D, palp; E, tarsus and metatarsus I; F, tarsus and metatarsus IV; G-O, *tasmaniensis* n.s.p.: G-N, adult; G, outline; H, crista and eyes; I, ant. sensillary area; J, post. sensillary area; K, mouth-parts from below; L, palp; M, tarsus and metatarsus I; N, tarsus and metatarsus IV; O, tarsus and metatarsus I of nymph. P-W, *novae-hollandiae* Wom. 1936; P-U, adult: P, crista and eyes; Q, ant. sensillary area; R, post. sensillary area; S, palp from above; T, tarsus and metatarsus I; U, tarsus and metatarsus IV; V-W, nymph: V, dorsum; W, tarsus and metatarsus I. All tarsi and metatarsi are to same magnification.

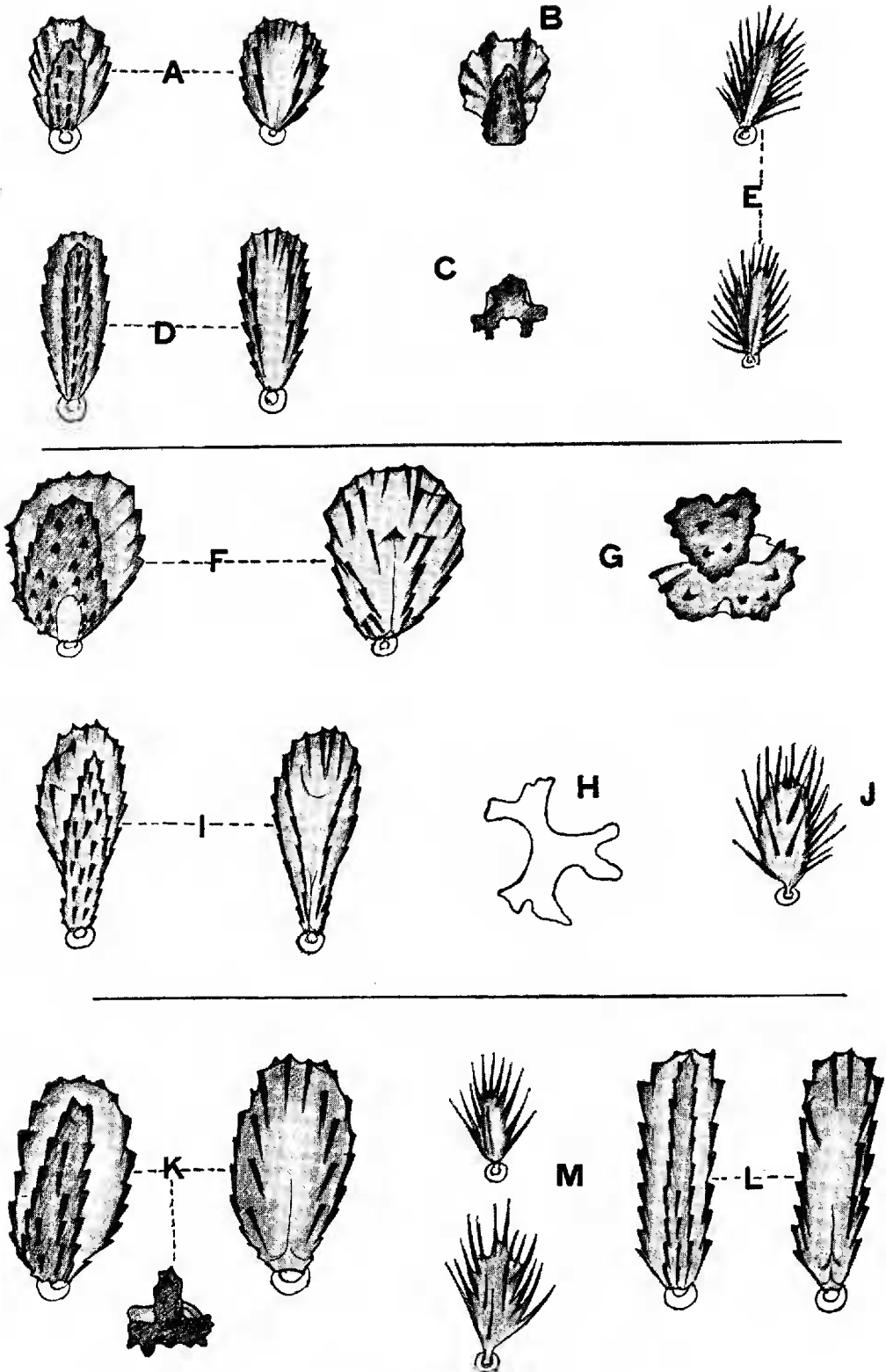


Fig. 5

ciliations. This suggests that he had more than one species. The figures of the setae given for *ampulligera* by Berlese, and for *sericea* and his second species by Jacot, do not permit of comparison with the three Australasian species.

- 1 Tarsus I four times as long as high. Anterior sensillae not tapering, expanding slightly distally and here with long ciliations; posterior sensillae very slender.

H. scalaris Womersley 1934

Tarsus I not more than twice as long as high. Anterior sensillae tapering.

2

- 2 Tarsus I one and one-half times as long as high. Posterior sensillae fairly thick, about 100 μ long. Dorsal setae widest about middle, dorsal flange of setae narrower, without basal excavations.

H. tasmaniensis n. sp.

Tarsus I twice as long as high. Posterior sensillae slender, about 50 μ . Dorsal setae widest beyond middle; flange on dorsal surface broader, with basal excavations.

H. novae-hollandiae Womersley 1936

Genus SPHAEROTARSUS Womersley

J. Linn. Soc., London (Zool.), 1936, 40, 269, 119. Type *S. allmani* Wom.

SPHAEROTARSUS RIPICOLUS (Womersley, 1934) Fig. 6, A-H; 7, A-F

Sphaerotarsus ripicolus (Womersley, 1934).

Cacculisoma ripicola Womersley, 1934 (nymph), Rec. S. Aust. Mus., 5, (2), 239.

Sphaerotarsus allmani Womersley, 1936 (part), J. Linn. Soc. (*loc. cit.*).

Description of Adult, fig. 6, A-D; 7, A-D—Red. Oval, somewhat pointed anteriorly, and with prominent shoulders. Length about 1.0 mm., width about 0.6 mm. Crista linear with anterior and posterior sensillary areas each with two somewhat clavate, finely ciliate sensillae, anterior sensillae 23 μ long, posterior 40 μ ; distance between centres of sensillae 264 μ . Eyes 1 + 1 behind middle of crista. Palpi very similar to nymph, but with a few more setae. Dorsal setae numerous, brown, short, ovoid (narrowing slightly distally), 3-flanged, with crossbars, and with adnate serrations, 18-24 μ long (some dorsal setae are unpigmented). Ventral setae posteriorly similar to dorsal, anterior to anus oval, with long strong ciliations, setae 17-22 μ long. Legs: I, (?) μ , II 820 μ long, III 870 μ , IV 1,170 μ (including coxae); tarsus I and metatarsus I not available, tarsus IV (δ) oval, 147 μ long by 94 μ across, metatarsus IV (δ) 230 μ long.

Redescription of Nymph, fig. 6, E-H; 7, E-F—Red. Shape as in adult. Length 0.875 mm., width 0.56 mm. Crista as in adult, anterior sensillae 22 μ long, posterior 43 μ . Distance between centres of sensillae 215 μ . Eyes as in adult. Palpi as figured. Dorsal setae shortly ovoid or elongate-ovoid, 3-flanged, with serrations, and with crossbars, 20-32 μ long; ventral setae posteriorly similar to dorsal, anterior to anus elongate-oval, with long strong ciliations, 18-20 μ long. Legs: I 805 μ long, II 555 μ , III 625 μ , IV 780 μ (including coxae); tarsus I 112 μ long by 49 μ across, metatarsus I 161 μ long, tarsus IV 63 μ long by 34 μ high, metatarsus IV 170 μ long.

Localities—South Australia: Victor Harbour, by sweeping tea-tree along Hindmarsh River, January 1934, five nymphs (including type) (H. W.); Glen Osmond, November 1937, one nymph (R. V. S.). Victoria: Sandy Waterhole, Glenelg River, January 1941, one adult δ (H. W.).

Erratum—Rec. S. Aust. Mus., 1934, p. 239, fig. 184 and 185 should be transposed.

Fig. 5

Hirstiosoma, dorsal and ventral setae—A-E, *scalaris* Wom. 1934: A, dorsal seta of adult above and below; B, same, end view from above; C, same, transverse section; D, dorsal seta of nymph from above and below; E, ventral setae, adult above, nymph below. F-J, *tasmaniensis* n. sp.: F, dorsal seta of adult from above and below; G, same, end view; H, same, transverse section; I, dorsal seta of nymph from above and below; J, ventral seta of adult. K-M, *novae-hollandiae* Wom. 1936: K, dorsal seta of adult from above, below and end view; L, dorsal seta of nymph from above and below; M, ventral setae, adult above, nymph below.

(All to same magnification.)

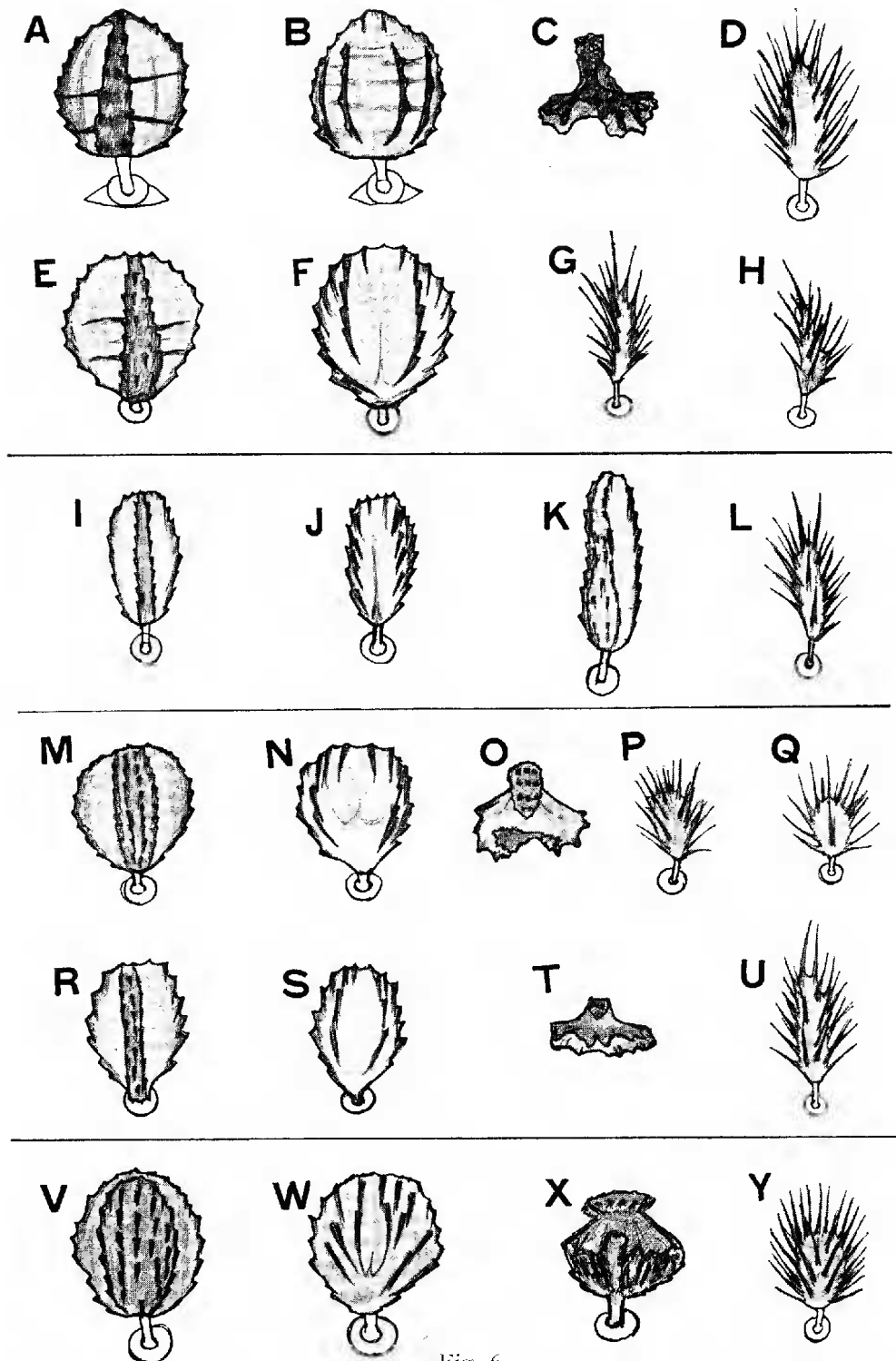


Fig. 6

Sphacrotarsus, dorsal and ventral setae—A–II, *S. ripicolus* (Wom. 1934), A–D adult: A, dorsal seta above; B same, below; C, same, end view; D, ventral seta; E–H, nymph, E, dorsal seta, above; F, same, below; G, II, ventral seta; H, ventral seta. I–L, *S. leptopilus* n. sp., nymph: I, dorsal seta, above; J, same, below; K, longer dorsal seta; L, ventral seta. M–U, *S. allmani* Wom. 1936, M–Q adult: M, dorsal seta, above; N, same, below; O, same, end view; P, Q, ventral setae; R–U, nymph: R, dorsal seta above; S, same, below; T, same, end view; U, ventral seta. V–Y, *S. claviger* n. sp., adult: V, dorsal seta, above; W, the same, below; X, same, end view (from below); Y, ventral seta. (All setae to same scale).

Sphaerotarsus leptopilus n. sp. Fig. 6, 1-L; 7, G-M

Description of Nymph—Colour red. Oval in outline, somewhat pointed anteriorly, and with prominent shoulders. Length 0.91 mm., width 0.67 mm. Crista linear with anterior and posterior sensillary areas, each with two clavate.

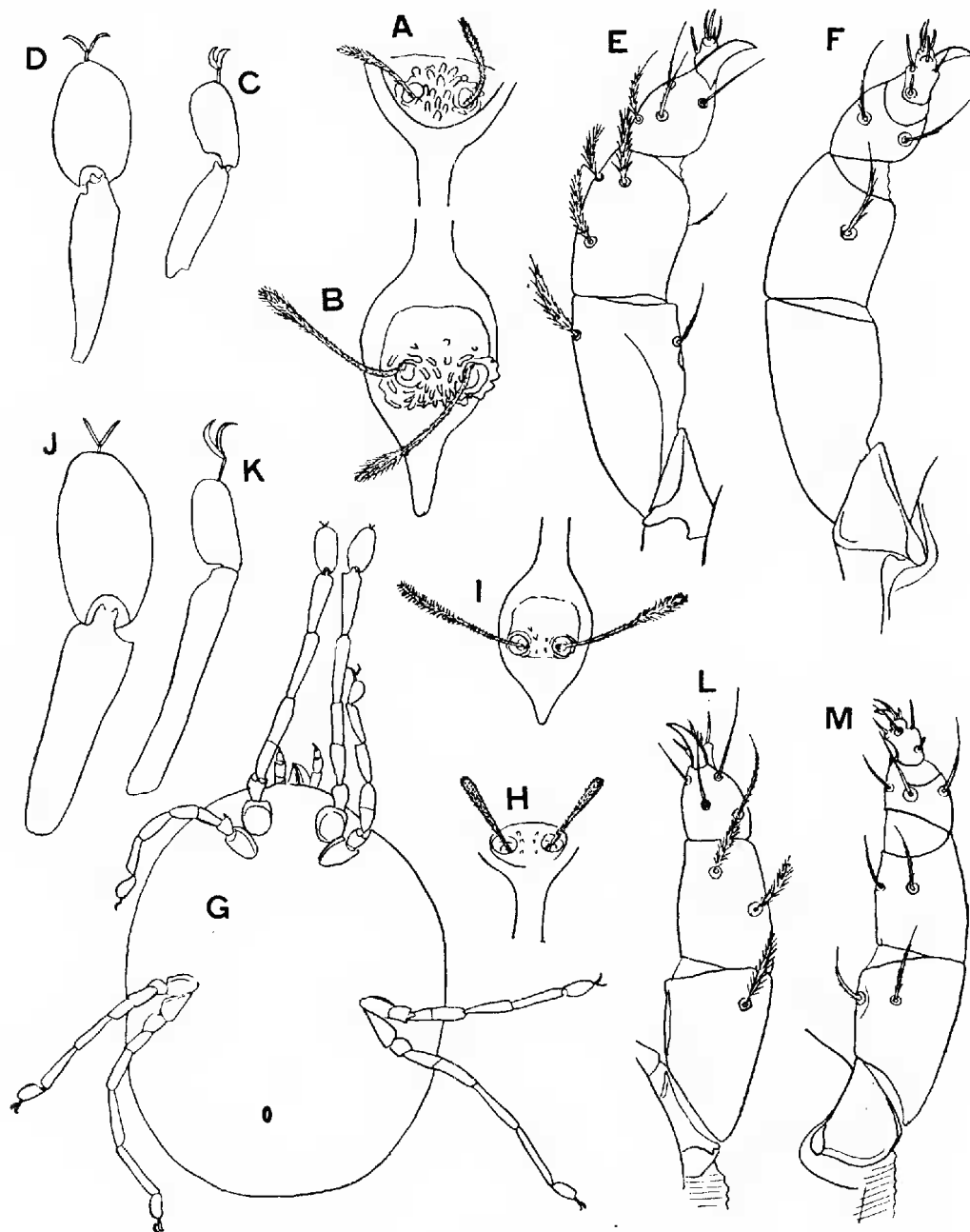


Fig. 7

Sphaerotarsus—A-F, *S. ripicolus* (Wom. 1934), A-D adult: A, anterior sensillary area; B, posterior sensillary area; C, tarsus II and metatarsus II, outline; D, tarsus IV and metatarsus IV, (δ) outline; E-F, nymph; E, palp from above; F, palp from below. G-M, *S. leptopilus* n. sp., nymph: G, outline, entire, ventral; H, anterior sensillary area; I, posterior sensillary area; J, tarsus I and metatarsus I, outline; K, tarsus IV and metatarsus IV, outline; L, palp, above; M, palp, below. (A-B; C-D; E, F, L, M; H-I; J, K, to same magnification.)

finely ciliate sensillae, anterior sensillae $22\ \mu$ long, posterior $34\ \mu$; distance between centres of sensillae $163\ \mu$. Eyes $1 + 1$, behind middle of crista. Palpi as figured. Dorsal setae numerous, brown, elongate-ovoid, 3-flanged, with serrations, and small for genus, $14\text{--}30\ \mu$ long, the posterior setae being the longer. Dorsal setae without the crossbars present in *S. ripicolus*. Ventral setae posteriorly similar to dorsal, anterior to anus elongate (fusiform) with long strong ciliations, $14\text{--}20\ \mu$ long. Legs: I $655\ \mu$ long, II $465\ \mu$, III $500\ \mu$, IV $585\ \mu$ (including coxae), tarsus I $95\ \mu$ long by $52\ \mu$ across, metatarsus I $129\ \mu$ long, tarsus IV $56\ \mu$ long by $24\ \mu$ high, metatarsus IV $136\ \mu$ long.

Locality—South Australia—Victor Harbour, by sweeping tea-tree along Hindmarsh River, January 1934, one nymph (type) (H. W.).

Remarks—Closest to *S. ripicolus*, with which it was originally taken, but differs in the form of the dorsal setae, and in the dimensions of sensillae. The single nymph was among the syntypes of *S. ripicolus*.

SPIHAEROTARSUS ALLMANI Womersley 1936 Fig. 6, M-U; 8, A-J

= *Sphaerotarsus allmani* Wom. 1936, J. Linn. Soc., Lon (Zool.), **40**, 269, 119.

Redescription of Adult, fig. 6, M-Q; 8, A-D—Red. Oval, somewhat pointed anteriorly, and with prominent shoulders. Length $1.1\ \text{mm.}$, width $0.7\ \text{mm.}$ Crista linear with anterior and posterior sensillary areas, each with two somewhat clavate finely ciliate sensillae, anterior sensillae $27\ \mu$ long, posterior $75\ \mu$, distance between centres of sensillae $290\ \mu$. Eyes $1 + 1$, behind middle of crista. Palpi as in nymph. Dorsal setae numerous, brown, short, 3-flanged, without crossbars, with serrations, $16\text{--}20\ \mu$ long; ventral setae posteriorly similar to dorsal, anterior to anus a short oval, $16\text{--}19\ \mu$ long, with long ciliations. Legs: I $1,155\ \mu$ long, II $705\ \mu$, III $760\ \mu$, IV $1,050\ \mu$ (including coxae); tarsus I $154\ \mu$ long by $73\ \mu$ high, metatarsus I $205\ \mu$ long; tarsus IV (δ) nearly spherical, $148\ \mu$ long by $127\ \mu$ across, metatarsus IV $209\ \mu$ long. No genital discs.

Description of Nymph, fig. 6, R-U; 8, E-J—Red. Shape as in adult. Length $0.77\ \text{mm.}$, width $0.5\ \text{mm.}$ Crista as in adult, anterior sensillae $20\ \mu$ long, posterior $62\ \mu$, distance between centres of sensillae $194\ \mu$. Eyes as in adult. Palpi as figured. Dorsal setae similar to adult, but more elongate, $18\text{--}30\ \mu$ long, ventral setae posteriorly similar to dorsal, anterior to anus elongate-oval, with long strong ciliations, setae $15\text{--}20\ \mu$ long. Legs: I $835\ \mu$ long, II $485\ \mu$, III $525\ \mu$, IV $715\ \mu$ (including coxae), tarsus I $109\ \mu$ long by $41\ \mu$ across, metatarsus I $167\ \mu$ long, tarsus IV $60\ \mu$ long by $26\ \mu$ high, metatarsus IV $167\ \mu$ long.

Locality—New South Wales: Bathurst, under fallen leaves, 31 May 1934, one adult δ (type) and two nymphs (S. L. A.).

Sphaerotarsus claviger n. sp. Fig. 6, V-Y; 8, M-Q

Description of Adult—Colour red. Oval in outline, somewhat pointed anteriorly, and with prominent shoulders. Length $1.315\ \text{mm.}$, width $0.755\ \text{mm.}$ Crista linear with anterior and posterior sensillary areas, each with two clavate, finely ciliate sensillae, anterior sensillae $20\ \mu$ long, posterior $63\ \mu$, distance between

Fig. 8

Sphaerotarsus—A-J *allmani* Wom. 1936, A-D adult: A, anterior sensillary area, B, posterior sensillary area; C, tarsus I and metatarsus I, outline; D, tarsus IV and metatarsus IV (δ), outline; E-J, nymph; E, anterior sensillary area; F, posterior sensillary area; G, tarsus I and metatarsus I, outline; H, tarsus IV and metatarsus IV, outline; I, palp above; J, palp, below. K-Q, *claviger* n. sp., adult: K, outline, entire, dorsal; L, anterior sensillary area; M, posterior sensillary area; N, tarsus I and metatarsus I; O, tarsus IV and metatarsus IV, (δ) outline; P, palp, above; Q, palp, below. (A, B, E, F, L, M; C, D, N, O; G, H; I, J, P, Q to same magnification.)

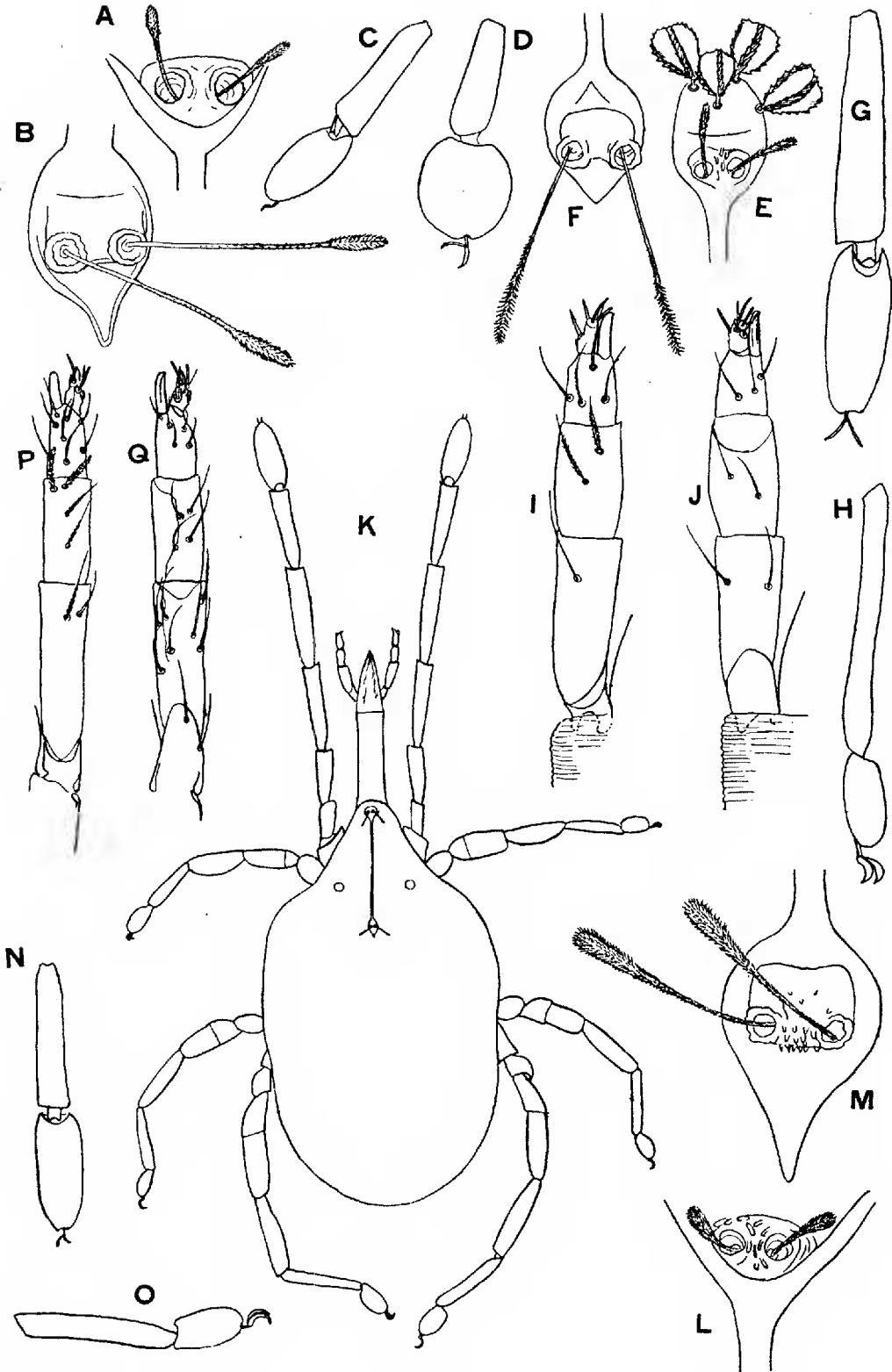


Fig. 8

centres of sensillae 352μ . Eyes $1 + 1$, behind middle of crista. Palpi as figured. Dorsal setae numerous, brown, short, 3-flanged, the dorsal flange being fairly broad, without crossbars and with serrations, setae $16-21 \mu$ long. Ventral setae posteriorly similar to dorsal, anterior to anus oval, with long strong ciliations, setae $15-22 \mu$ long. Legs: I $1,335 \mu$ long, II 805μ , III 880μ , IV $1,205 \mu$ (including coxae); tarsus I 178μ long by 66μ across, metatarsus I 242μ long, tarsus IV (♀) 106μ long by 49μ high, metatarsus IV 247μ long.

Locality—New South Wales: Bathurst, "under bark," 28 June 1932. ♂ (S.L.A.)

REMARKS ON THE GENUS SPHAEROTARSUS

The dorsal setae vary somewhat in form and size on different parts, especially so in the nymph. In the figures given, a typical dorsal seta, from the anterior two-thirds in each case, is shown. Those of the posterior part of the dorsum are more elongate than those more anterior.

The specific characters of most value are the structure and dimensions of the sensillae, and the character of the dorsal setae. The genus is, at present, confined to Australia.

KEY TO THE SPECIES OF SPHAEROTARSUS

- 1 Posterior sensillary setae $1.5 \times$ as long as anterior. Dorsal setae elongate-oval, length: breadth = $2.5:1$. (Anterior sensillae 22μ long, posterior 34μ .)
S. leptopilus n. sp
- 2 Posterior sensillary setae $2.0 \times$ as long as anterior, or more.
2
- 2 Posterior sensillary setae $2.0 \times$ as long as anterior. Dorsal setae broadly ovoid, narrowing slightly distally. (Anterior sensillae 22μ , posterior 45μ .)
S. ripicolus (Wom. 1934)
- 3 Posterior sensillary setae about $3.0 \times$ as long as anterior.
3
- 3 Dorsal flange of dorsal seta comparatively narrow, less than one-third breadth of seta, and with (generally) four longitudinal rows of serrations. On ventral surface of dorsal seta is a very broad clear central area. Posterior sensillae widest a little away from their distal end.
S. allmani Wom. 1936
- 3 Dorsal flange of dorsal seta comparatively broad, more than one-third of breadth of seta, and with (generally) 6 longitudinal rows of serrations. The central clear area on the ventral surface of the dorsal seta is narrower. Posterior sensillae widest right at their distal end.
S. claviger n. sp.

SUMMARY

In this paper the family Smarididae Kramer 1878 is reviewed and the generic characters evaluated. The genera *Smaris* Latreille 1796, *Fessonia* von Heyden 1826, *Hirstiosoma* Womersley 1934, and *Sphaerotarsus* Womersley 1936 are included, but *Microsmaris* Hirst 1926 is excluded (it belonging to the Erythracidae). The genus *Smaris* includes *S. squamata* (Hermann 1804) from Europe, *S. depilata* (Berl. 1888) from South America and *S. prominens* (Banks 1916) from Australia. *Sphaerotarsus* has four species—*S. ripicolus* (Womersley 1934), *S. allmani* Womersley 1936, **S. leptopilus** n. sp., **S. claviger** n. sp., all from Australia. *Fessonia* is at present restricted to *F. papillosa* (Hermann 1804) from Europe. *Hirstiosoma* contains *H. scalaris* Womersley 1934 and **H. tasmaniensis** n. sp. from Australia, *H. novae-hollandiae* Womersley 1936 from New Zealand; *H. ampulligera* (Berlese 1887) from Europe and (doubtfully) South America, *H. sericea* (Say 1821, Jacot 1938) and indet. sp. (Jacot 1938) from North America.

The first larval Smaridid, that of *S. prominens* (Banks), is described. It has been reared through the resting or pupal stage to the nymph which has been correlated morphologically with the adult. The nymphs of the Australasian species of *Hirstiosoma* and *Sphaerotarsus* are described and correlated (on morphology) with the adults.